

Larval and Juvenile Fishes Caught in a Neuston Survey of Buzzards Bay, Massachusetts in 1979

by

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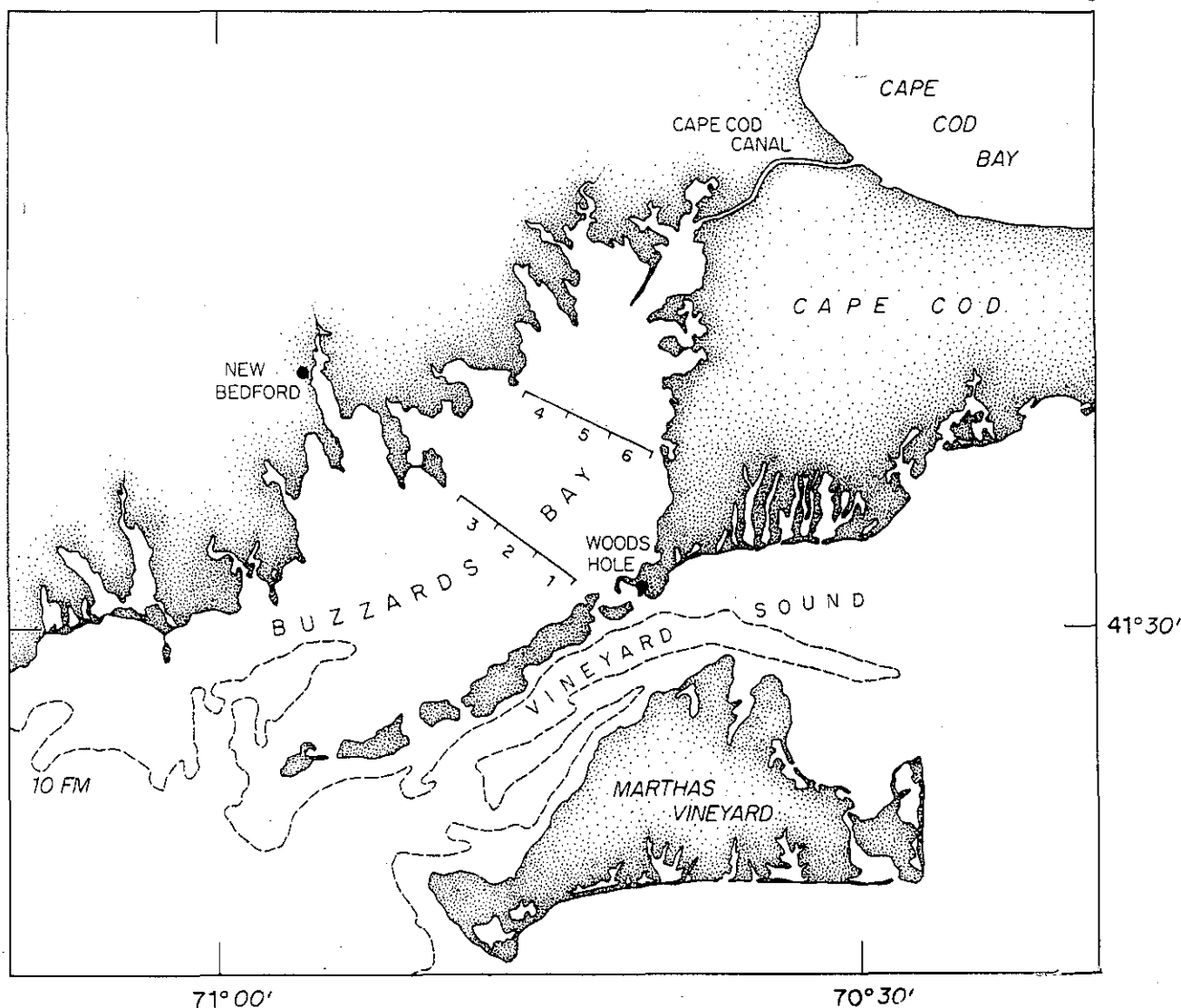


Figure 1. Sampling stations for Buzzards Bay neuston tows in 1979.

INTRODUCTION AND METHODS

We made weekly neuston tows in Buzzards Bay in spring and summer months from 1976 through 1979 to sample lobster larvae, which are pelagic from May to early August in this area (Lux, *et al.* 1983). In the course of the sampling we caught other invertebrates and many fish species. To learn more about the sizes and seasons of occurrence of baby fish in the neuston layer and also about fish spawning and nursery grounds, we extended the sampling in 1979 to early November. Thus we sampled from May 3 to November 5, covering much of the season when fish are found in any numbers in the neuston there. This paper reports on the fishes caught in 1979, and expands on a paper by Lux (1984) which presented a species list.

Buzzards Bay varies in depth from about 5 m at the northeast end, except for the dredged ship channel leading to the Cape Cod canal, to about 30 m at the bay mouth (Figure 1). Sediments are largely sand and silt, although there are areas of rocky bottom and, along the western shore, rock ledge. The bay is within Massachusetts territorial waters and is closed by state law to fishing with trawls or nets. There are, however, both commercial and recreational fisheries for lobsters, finfish, and shellfish with gear other than nets.

The sampling methods were described by Lux, *et al.* (1983) and are briefly reviewed next. The nylon neuston net used had a 1 X 2 m mouth kept open by an aluminum frame, was 9 m in length, and had a bar mesh measure of 0.97 mm. It was towed, long axis horizontal, from the end

of a boom extending 2.5 m out from the side of a 12 m research vessel. Tows were made in a straight line at each of the six stations along the station tracks (Figure 1) with the net about 20 m astern and to the side of the vessel wake. The net mouth was from one-half to two-thirds submerged. Towing speed, determined by an electronic log, was 6 km/hr (3.25 kn).

Up to mid-July, tows were 30 minutes long; after that, because of net clogging by algae and/or ctenophores, they were shortened to 15 or 20 minutes. At 6 km/hr the approximate water volume filtered per 30 minute tow was 3,000 m³, assuming that a surface layer 0.5 m deep was sampled and filtration was perfect, or about 100 m³ per minute towing time. Based on towing time only, and unadjusted for any net clogging that may have occurred, the estimated water volumes filtered in each month of sampling, in thousands of cubic meters, were: May, 69; June, 57; July, 65; August, 46; September, 42; October, 45; November, 9.

The mean surface-water temperature in Buzzards Bay for all stations on a given sampling date May to mid-August 1979 is given in Figure 2, along with mean weekly surface temperatures recorded at the NMFS dock in Woods Hole for the entire period, May-November 1979. In the summer the surface in Buzzards Bay is slightly warmer than at Woods Hole. Based on our observations of earlier years, the temperature at the bottom in the bay during summer months is one or two degrees lower than at the surface.

All six stations were sampled once each week, weather permitting, on 28 sampling dates. On a sampling date, towing commenced at about 0900 h (EDT) and was completed by about 1400 h. The catch from each tow was separated from floating seaweeds, preserved in 2 percent formaldehyde, and sorted later, in the laboratory. The fish caught were in most cases larvae and juveniles; however, adults of at least two species also were caught. Jones, *et al.* (1978), define a fish larva as the "...stage between absorption of yolk and acquisition of minimum adult fin ray complement;" and a juvenile as the "...stage between acquisition of minimum adult fin ray complement and sexual maturity..." We follow these definitions here, except that when we refer to a fish as a larva or a juvenile we mean it is a fish of the year (*i.e.*, 0-group).

The fish were separated by species and total lengths were recorded. In a few cases where samples were large, subsamples only were measured, as noted in the text below. Since the mesh size in the neuston net was too large to retain many of the smaller larvae, we measured only

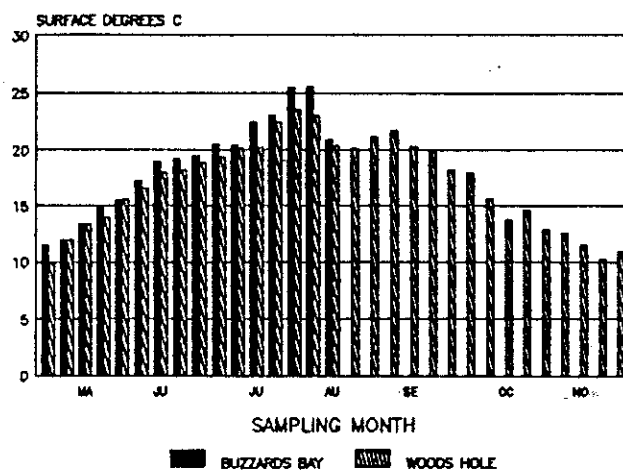


Figure 2. Surface temperature at Buzzards Bay neuston stations, May-August, 1979 and at Woods Hole, May-November, 1979.

those fish 5 mm and over in length. Even so, some thin-bodied fish of 5 mm or more may have passed through the meshes; and that larger sizes of some of the species were not caught may have been due to their evasion of the net, once they had grown large enough to do so, rather than their absence in surface waters. However, it is well known that most bottom fish with pelagic juvenile stages take to the bottom at rather small sizes.

Due to the large variations in catch from tow to tow, the variation in towing time from month to month, and the problems of net clogging, the catch data, while showing seasons of greatest numbers in the neuston, only roughly measure abundance.

For information on life histories and identification of the species caught we relied largely on *Fishes of the Gulf of Maine* by Bigelow and Schroeder (1953), the six-volume atlas of data on fish egg, larval, and juvenile stages titled *Development of Fishes of the Mid-Atlantic Bight* (1978) by various authors, and the identification guide assembled by Colton and Marak (1969). For a few species, unpublished information developed by scientists at the NMFS Sandy Hook laboratory was useful for identifications. Ordinarily, it would be difficult in some cases to identify to species, larvae of only 5 mm in length; having a series of sizes from larva to juvenile, as we often had, simplified that problem.

There were 28 fish species caught, all of which have been reported from this general area (Smith 1898; Bigelow and Schroeder 1953). Brief notes, species by species, on the biology, abundance, sizes, and season of occurrence follow. To show size composition length frequency graphs

are presented for the more abundant species. Geographical ranges, where given, are for off North America. It is useful to keep in mind that the strong tidal currents in the Cape Cod Canal bring some Cape Cod Bay water into Buzzards Bay with each tidal cycle, and with it, drifting sea life. Similarly, currents in Nantucket and Vineyard sounds transport some organisms from other areas to the vicinity of Buzzards Bay. Also, northward and shoreward drift from the Middle-Atlantic Bight brings some fish from southern and Gulf Stream waters to the southern New England coast. Given these conditions, one can not identify with certainty the origin of some of the young fishes found in an area such as Buzzards Bay, and information on their usual distributions and spawning areas must be relied upon for estimating where they originated. In addition to the 28 species reported here, other fishes, particularly those without pelagic stages, spawn in the Woods Hole area.

The adults and juveniles of some of the fish species that appeared in the neuston have been recorded in logs of the Bureau of Commercial Fisheries M/V *Blueback*, from catches of a fish trap in Buzzards Bay that was used during the summers of 1961-69 to supply specimens for the NMFS aquarium in Woods Hole.

RESULTS AND DISCUSSION

Clupeidae—herrings

Brevoortia tyrannus (Latrobe) Atlantic menhaden

The three larval menhaden caught were taken on July 10. They were 15, 15, and 16 mm in length for a mean of 15.3 mm. This migratory species, ranging from Florida to Maine, is found off New England in summer. Bigelow and Schroeder (1953) indicate that spawning is at sea and that "the main body of the fish off southern New England spawn in June, continuing through July and August." Schools of juvenile menhaden are common at the surface in the Woods Hole area in late summer.

Clupea harengus Linnaeus Atlantic herring

Eight larval herring occurred in catches of late October (length range: 13-28 mm; mean

length: 24.8 mm). Off the United States this species, which is found from Cape Hatteras to Labrador, spawns mostly on Georges Bank and northward in the summer and autumn (Bigelow and Schroeder 1953; Jones, *et al.* 1978). Juveniles occasionally are found near the surface during summer at Woods Hole; in late July 1971, for example, we dip-netted 30 from the dock there with a mean total length of 67 mm.

Engraulidae—anchovies

Anchoa sp.

anchovy

We identified the anchovies only to genus. Four juveniles occurred in August catches (length range: 32-36 mm; mean length: 34.2 mm) and three larvae were caught in late September (length range: 14-23 mm; mean: 17.3 mm). All may have been of a single species. The two species that are found off New England are *A. mitchilli* and *A. hepsetus*; the latter is a stray in this area from more southern grounds (Bigelow and Schroeder 1953).

Anguillidae—freshwater eels

Anguilla rostrata (Lesueur) American eel

A single American eel in the elver stage, 53 mm in length, was caught May 9. Elvers off southern New England normally are moving into fresh water streams at this time of the year (Bigelow and Schroeder 1953), and are more common at stream mouths than in deeper water of the bay.

Cyprinodontidae—killifishes

Fundulus heteroclitus (Linnaeus) mummichog

A single mummichog larva 8 mm in length was caught in August. This is a species of sheltered shores, tidal creeks of marshes, and estuaries from Florida to Newfoundland (Bigelow and Schroeder, 1953), and this specimen was a stray from these habitats.

Table 1. Numbers of fish, length ranges (mm), and mean lengths (mm) of *Enchelyopus cimbrius* in Buzzards Bay neuston catches in 1979

Statistic	May	June	July	Oct	Nov
Number of fish	623	1,204	239	3	9
Length range	5-26	5-39	5-25	30-38	12-28
Mean length	12.6	17.1	11.9	34.3	18.6

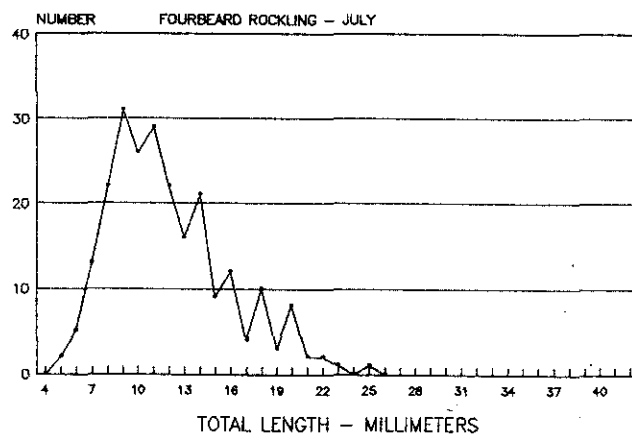
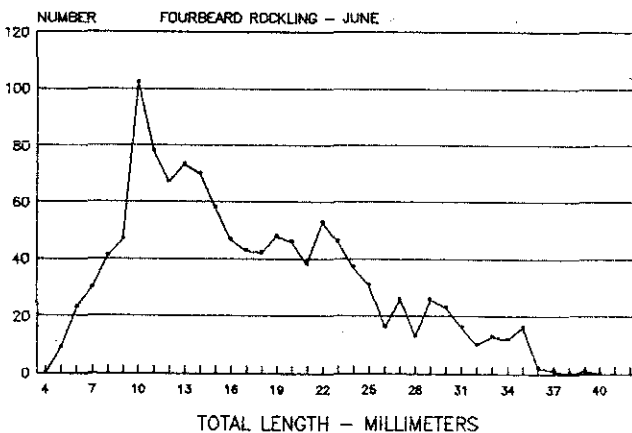
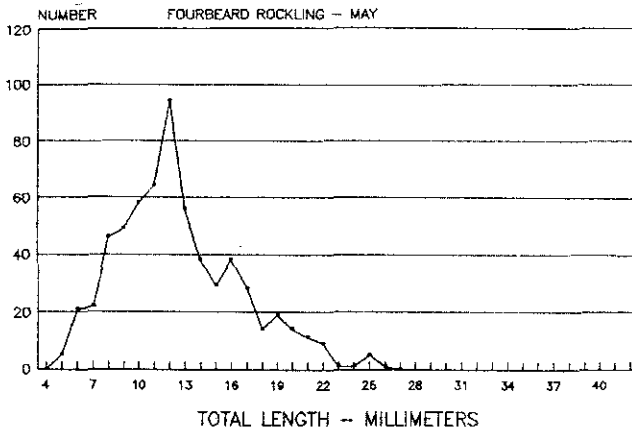


Figure 3. Length frequencies of fourbeard rockling from Buzzards Bay neuston tows in May-July 1979.

Gadidae—codfishes and hakes

Enchelyopus cimbrius (Linnaeus) fourbeard rockling

This species, the one most commonly occurring in the neuston (Table 1), first appeared May 22. Catches included both larvae and juveniles. Length frequencies (Figure 3) show that there were larger fish in the neuston in June than in May or July. Despite the large numbers in the neuston, it was not recorded in otter trawl tows at Woods Hole (Lux and Nichy 1971). This rockling is distributed from the Gulf of St. Lawrence to Narragansett Bay; it spawns, in New England, mainly from February to August (Bigelow and Schroeder 1953; Hardy 1978a). Of the June catches, about a 50 percent subsample only was measured, but sampling error precluded adjusting the June data to reflect this.

Gadus morhua Linnaeus

Atlantic cod

A single cod larva, 6 mm in length, was caught May 22. Cod spawn in winter and spring and, off the United States, largely on Georges Bank and in the Gulf of Maine; however, there also is some spawning off southern New England as well (Bigelow and Schroeder 1953).

Pollachius virens (Linnaeus)

pollock

Thirty-three larval and juvenile pollock (length range: 6-34 mm; mean length: 20.8 mm) were caught in May and June. These were of two size groups, with respect to time of capture: for the May 3 and May 9 tows the length range of the 27 caught was 16-34 mm with a mean of 23.7 mm; for the six caught May 29 and June 4, likely from a later spawning, the length range was 6-10 mm with a mean of 8.0 mm. This fall to spring spawner, found from Virginia to Labrador, reportedly does not spawn west of the Gulf of Maine (Bigelow and Schroeder 1953), although the larvae have been found as far west as off New York (Hardy 1978a). Fish of the 0-group frequent the Buzzards Bay area, for they often are seen at the surface around the docks at Woods Hole, and they have been trawled on the bottom there from mid-March to July (Lux and Nichy 1971).

Table 2. Numbers of fish, length ranges (mm), and mean lengths (mm) of *Urophycis chuss* in Buzzards Bay neuston catches in 1979

Statistic	July	Aug	Sept	Oct	Nov
Number of fish	319	1,131	248	113	1
Length range mm	7-35	5-30	5-29	6-31	—
Mean length mm	15.3	13.2	14.1	18.7	29

Urophycis chuss (Walbaum)

red hake

Characters identified by Musick (1973) were of use in separating young *U. chuss* from those of *U. tenuis*. Red hake larvae and juveniles first were caught on July 14 (Table 2). This species, found from Cape Hatteras to Nova Scotia, has an extended spawning period lasting, off New England, from May through much of summer (Hardy 1978a), and this is shown in the fish sizes (Table 2, Figure 4). Some July catches were subsampled, and data in Table 2 and Figure 4 were adjusted to reflect this. A few juvenile red hake, 68-136 mm in length, have been caught in autumn otter trawl tows at Woods Hole (Lux and Nichy 1971).

Urophycis regia (Walbaum)

spotted hake

Twenty-five juvenile spotted hake (length range: 30-56 mm; mean length: 39.9 mm) were caught in late May and early June. Information from Hardy (1978a) indicates that spawning is in offshore waters from fall to late winter. Southern New England is about the northern limit of distribution for this species, which ranges well south of Cape Hatteras (Bigelow and Schroeder 1953).

Urophycis tenuis (Mitchill)

white hake

White hake juveniles occurred in catches from mid-May to late June. Thirty-eight were caught in May (length range: 23-58 mm; mean length: 36.6 mm) and 25 in June (length range: 35-57 mm; mean length: 44.8 mm). Spawning of this species, which is found from Cape Hatteras to Newfoundland, is believed to take place mainly in winter off New England (Bigelow and Schroeder 1953), and our catches may be from the previous winter's spawning. Juveniles have been caught

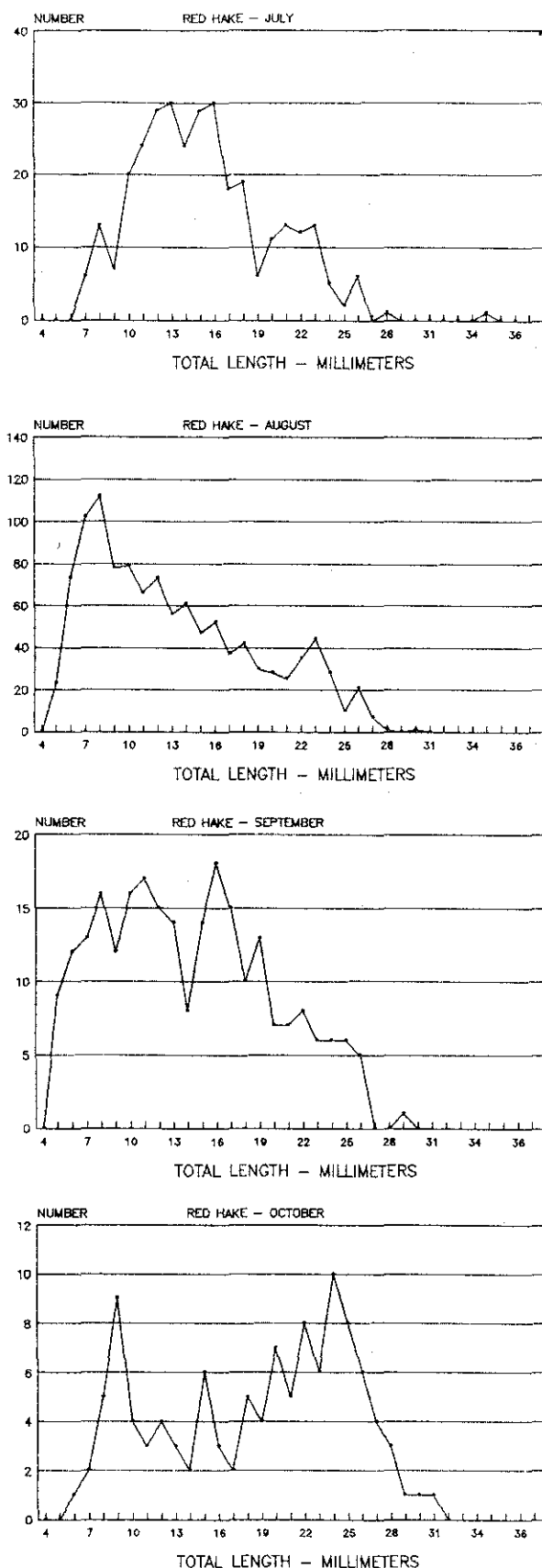


Figure 4. Length frequencies of red hake from Buzzards Bay neuston tows in July-October 1979.

Table 3. Numbers of fish, length ranges (mm), and mean lengths (mm) of *Gasterosteus aculeatus* in Buzzards Bay neuston catches in 1979

Statistic	May	June	July	Aug	Oct	Nov
Number of fish	31	228	178	1	5	23
Length range	17-43	12-44	9-33	—	35-41	34-49
Mean length	28.8	22.0	18.9	25	39.0	42.5

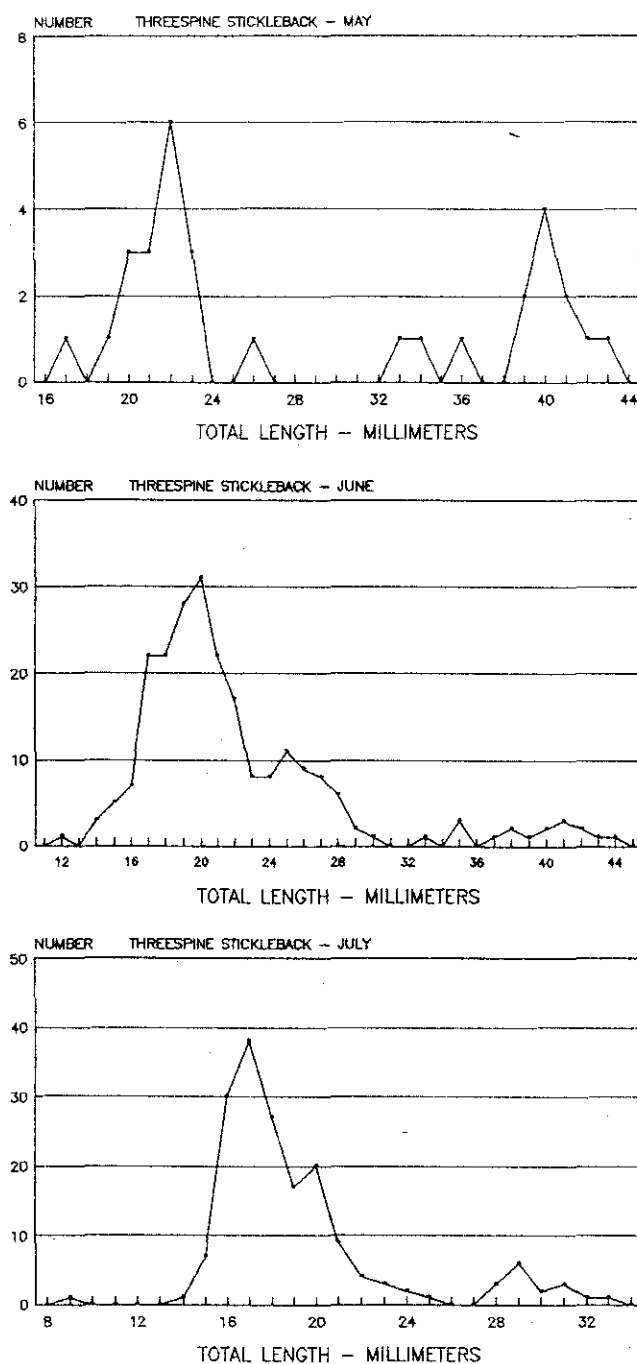


Figure 5. Length frequencies of threespine sticklebacks from Buzzards Bay neuston tows in May-July 1979.

in the spring and summer in bottom trawl tows at Woods Hole (Lux and Nichy 1971).

Gasterosteidae—sticklebacks

Gasterosteus aculeatus Linnaeus threespine stickleback

This species, found from about Cape Hatteras to Newfoundland, was one of the more common fishes in the neuston and appeared in catches from May 9 to November 5 (Table 3). The fish fell into two size groups in May and June (Figure 5): those ranging from 12 to about 30 mm in length, which we took to be larvae and juveniles; and those of about 33 to 44 mm in length, which we took to be adults (Hardy 1978a). While early catches were mostly larvae and juveniles, after August all of the fish fell into the "adult" category, possibly because some of the young had grown to this extent. This size division agrees with that given by Lux and Nichy (1971) for bottom trawl catches of this species at Woods Hole, although no larvae were caught in the trawl. Spawning for the Woods Hole area is in late winter to July (Hardy 1978a).

Two other sticklebacks, *Apeltes quadracus* (Mitchill) and *Pungitius pungitius* (Linnaeus), the latter only one fish, were caught in otter trawl catches at Woods Hole (Lux and Nichy 1971); neither appeared in the Buzzards Bay neuston catches.

Syngnathidae—pipefishes and seahorses

Syngnathus fuscus Storer northern pipefish

Pipefish, found from Florida to the Gulf of St. Lawrence, appeared in the neuston from early June to mid-October (Table 4). There were larvae, juveniles, and adults in the catches, with the young predominating. The larvae are released from the male's brood pouch at about 12 mm in length (Hardy 1978a). Larvae in our catches, fish less than about 21 mm long (Hardy 1978a), were present only through August (Figure 6), and we assume that breeding was largely completed by that time. This agrees with data from Bigelow and Schroeder (1953).

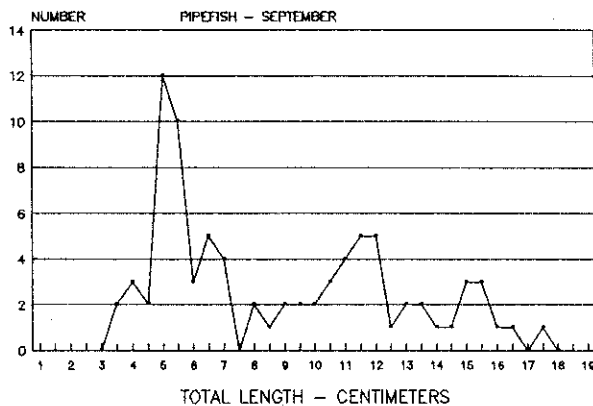
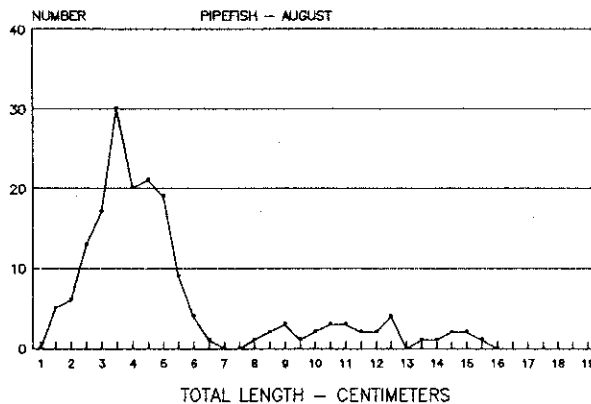
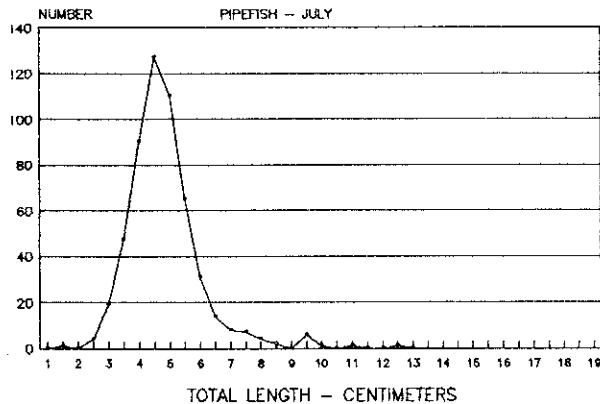
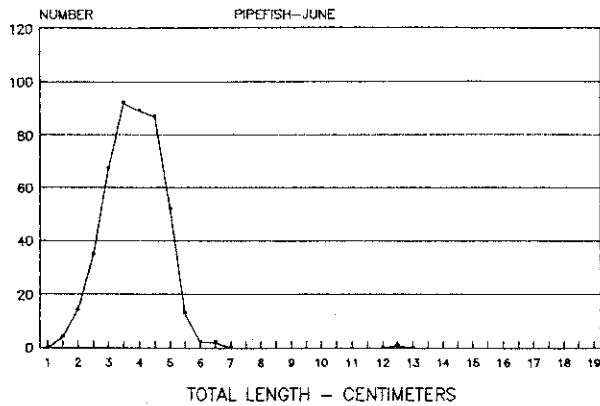


Figure 6. Length frequencies of northern pipefish from Buzzards Bay neuston tows in June-September 1979.

Table 4. Numbers of fish, length ranges (mm), and mean lengths (mm) of *Syngnathus fuscus* in Buzzards Bay neuston catches in 1979

Statistic	June	July	Aug	Sept	Oct
Number of fish	458	538	174	83	36
Length range	15-126	18-123	15-156	36-174	48-186
Mean length	38.5	48.3	51.5	88.1	82.5

Both juvenile and adult pipefish, but no larvae, have been caught in Woods Hole harbor bottom trawl tows (Lux and Nichy 1971); the mean length of these juveniles by late October was 156 mm.

Pomatomidae—bluefishes

Pomatomus saltatrix (Linnaeus)

bluefish

Twelve juvenile bluefish (length range: 16-42 mm; mean length: 25.6 mm) were caught in the neuston from late May to mid-August. Bluefish, found from Florida to Nova Scotia, spawn offshore from spring through much of summer, and the young make their way to coastal waters (Hardy 1978b). "Snapper" bluefish, juveniles of about 15-20 cm in length, often are common in the Woods Hole- Buzzards Bay area in late summer.

Coryphaenidae—dolphins

Coryphaena hippurus Linnaeus

dolphin

A single juvenile dolphin, 61 mm in length, was caught in mid- September. While this species, which is largely of tropical and sub-tropical waters, spawns far to the south of New England in spring and summer (Johnson 1978), the young occasionally drift to coastal waters around Cape Cod.

Sparidae—porgies

Stenotomus chrysops (Linnaeus)

scup

Seventeen larval scup (length range: 5-8 mm; mean length: 5.6 mm) were caught in the neuston, all on July 16. Along southern New England this species, which occurs from North Carolina to Cape Cod, spawns in spring to summer, principally in June (Bigelow and Schroeder 1953). Larvae and juveniles were common in summer and autumn bottom trawl catches at Woods Hole (Lux and Nichy 1971).

Labridae—wrasses

Tautogolabrus adspersus (Walbaum)

cunner

Larval and juvenile cunners occurred in neuston catches from June 4 to August 20 (Table 5, Figure 7). This common shallow-water fish, found from New Jersey to Newfoundland, spawns from late spring through early summer off southern New England (Bigelow and Schroeder 1953). Cunners in the neuston were mostly <16 mm in length. Juveniles were common in bottom trawl catches at Woods Hole from July to November (Lux and Nichy 1971).

Stichaeidae—pricklebacks

Lumpenus lumpretaeformis (Walbaum)

snakeblenny

Eighty-two larvae (length range 6-14 mm; mean length: 10.5 mm) were caught in neuston tows from May 9 to June 4 (Figure 8). The drifting larvae of this species, which is found from Cape Cod to Newfoundland, occur from March through about May in Gulf of Maine waters; it is believed to be a winter spawner, although little is known of its habits (Bigelow and Schroeder 1953).

Triglidae—searobins

Prionotus carolinus (Linnaeus)

northern searobin

This species, which is found mainly from

Table 5. Numbers of fish, length ranges (mm), and mean length (mm) of *Tautogolabrus adspersus* in Buzzards Bay neuston catches in 1979

Statistic	June	July	Aug
Number of fish	29	137	3
Length range	5-8	5-16	8-20
Mean length	5.5	8.7	12.3

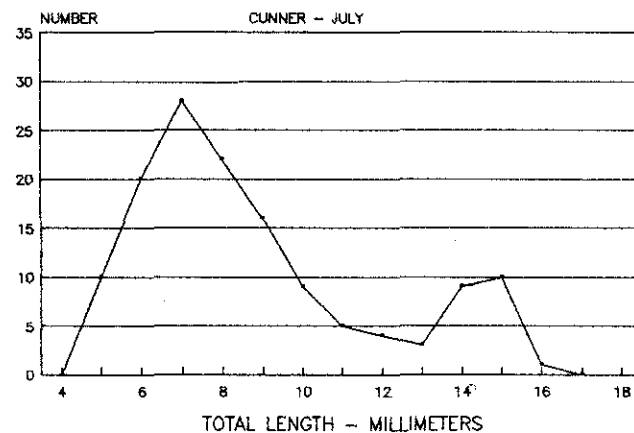
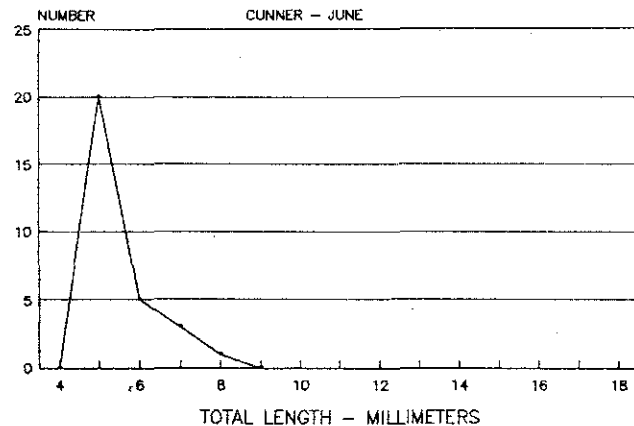


Figure 7. Length frequencies of cunners from Buzzards Bay neuston tows in June-July 1979.

South Carolina to Cape Cod, spawns in July and August in the Woods Hole area (Bigelow and Schroeder 1953). Forty-three larval sea robins (length range: 5-14 mm; mean length: 8.3 mm) occurred in neuston catches August 6-27. Juveniles of this species are common in bottom trawl catches at Woods Hole in summer and autumn (Lux and Nichy 1971). The striped sea robin, *P. evolans* (Linnaeus), a similar, more southern species, whose larval stages are unknown (Fritzsche 1978), is not known to spawn in the

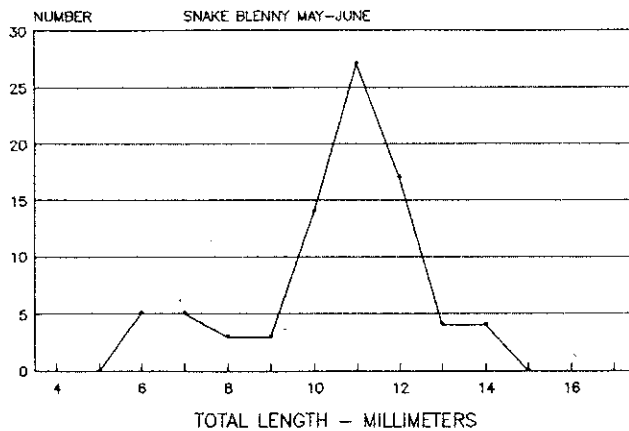


Figure 8. Length frequencies of snakeblenny from Buzzards Bay neuston tows in May-June 1979.

Cape Cod area and is uncommon there (Bigelow and Schroeder 1953), nor are juveniles reported from there. We therefore believe that all *Prionotus* larvae discussed above were *P. carolinus*.

Cyclopteridae—lumpfishes and snailfishes

Liparis inquilinus Able inquiline snailfish

Thirty-six larval snailfish were caught in the neuston May 17-29 (length range: 5-9 mm; mean length: 7.0 mm). This species, found from Cape Hatteras to Maine, spawns near shore in the spring, and the young are pelagic from about April to June (Fritzsche 1978).

Ammodytidae—sand lances

Ammodytes americanus DeKay American sand lance

Forty larval and juvenile sand lances occurred in neuston catches from May 9 to May 29 (length range: 6-42 mm; mean length: 18.7 mm). The spawning of sand lance, which are found from Cape Hatteras to Labrador, is in autumn to spring (Fritzsche 1978).

Table 6. Numbers of fish, length ranges (mm), and mean lengths (mm) of *Peprilus triacanthus* in Buzzards Bay neuston catches in 1979

Statistic	July	Aug	Sept	Oct
Number of fish	27	27	11	2
Length range	5-18	6-35	18-47	12-19
Mean length	8.5	16.1	32.4	16.0

Stromateidae—butterfishes

Peprilus triacanthus (Peck) butterfish

Larvae and juveniles were caught in the neuston from mid-July to October (Table 6). This species, of waters from South Carolina to Nova Scotia, spawns, off New England, from June to August (Bigelow and Schroeder 1953). Juveniles have been caught in summer otter trawl tows at Woods Hole (Lux and Nichy 1971).

Atherinidae—silversides

Menidia menidia (Linnaeus) Atlantic silverside

A total of 339 silversides were measured from early June to November (Table 7, Figure 9). Except for the largest fish in October, we believe that all were larvae and juveniles (Martin and Drewry 1978). Large catches in late June were subsampled; the overall proportion measured in this month was 15 percent, but because of sampling error the data for June in Table 7 and Figure 9 are unadjusted for the subsampling.

This species, of near-shore waters from Chesapeake Bay to the Gulf of St. Lawrence, spawns from May to early July along the southern New England coast (Bigelow and Schroeder 1953).

Smaller catches after July may have been due to net avoidance rather than absence from the surface layer, for silversides are fish of the upper waters from spring to fall. Since they form schools after a certain size, their distribution is patchy. Juvenile silversides have been caught in otter trawl tows at Woods Hole in July to September (Lux and Nichy 1971).

Table 7. Numbers of fish, length ranges(mm), and mean lengths(mm) of *Menidia menidia* in Buzzards Bay neuston catches in 1979

Statistic	June	July	Aug	Sept	Oct	Nov
No. of fish	228	91	1	3	15	1
Length range	5-28	5-32	—	30-72	59-91	—
Mean length	8.8	12.1	33	59.0	72.6	66

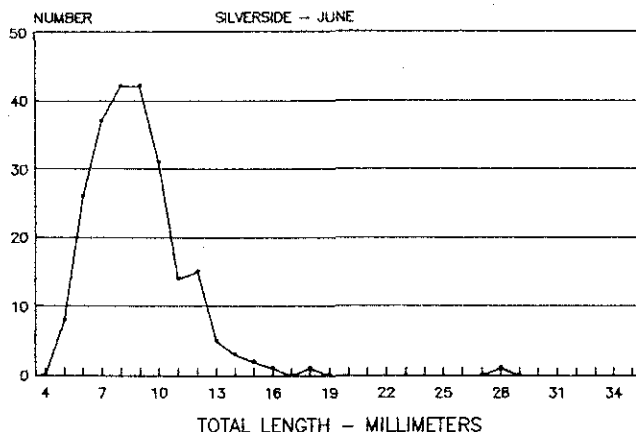


Figure 9. Length frequencies of silversides from Buzzards Bay neuston tows in June-July 1979.

Bothidae—lefteye flounders

Scophthalmus aquosus (Mitchill) windowpane

Twenty-four windowpane flounder larvae (length range: 5-10 mm; mean length: 7.1 mm) were caught in June, August, and October neuston tows. This flounder, of coastal waters from South Carolina to the Gulf of St. Lawrence, is a spring and summer spawner (Bigelow and Schroeder 1953). One juvenile windowpane, 53 mm long, was caught in otter trawl tows at Woods Hole in May (Lux and Nichy 1971).

Pleuronectidae—righteye flounders

Pleuronectes ferrugineus (Storer) yellowtail flounder

A single yellowtail flounder larva, 10 mm in length, was caught in a May 29 tow. This species, of moderate water depths from Chesapeake Bay to the Labrador coast, spawns offshore from late winter to summer (Bigelow and Schroeder 1953).

Pleuronectes americanus Walbaum winter flounder

Ten winter flounder larvae (length range 5-7 mm; mean length 6.3 mm) were caught in the May neuston tows. This winter and spring spawner, which is found from Georgia to Labrador, spawns in coastal waters and on some offshore banks; the larvae and juveniles, however, are not abundant in the upper water layers (Bigelow and Schroeder 1953), which likely accounts for the low numbers caught in our tows. We have, in years past, caught many of the larvae at the surface in spring plankton tows in Woods Hole passage, where strong currents vertically mix the water. Juveniles of this species were numerous in otter trawl catches at Woods Hole in June to December (Lux and Nichy 1971).

Table 8. Numbers of fish, length ranges (mm), and mean lengths (mm) of *Sphoeroides maculatus* in Buzzards Bay neuston catches in 1979

Statistic	June	July	Aug	Sept	Oct
Number of fish	5	867	41	5	1
Length range	5-6	5-20	5-18	6-12	—
Mean length	5.2	8.1	9.0	9.2	1

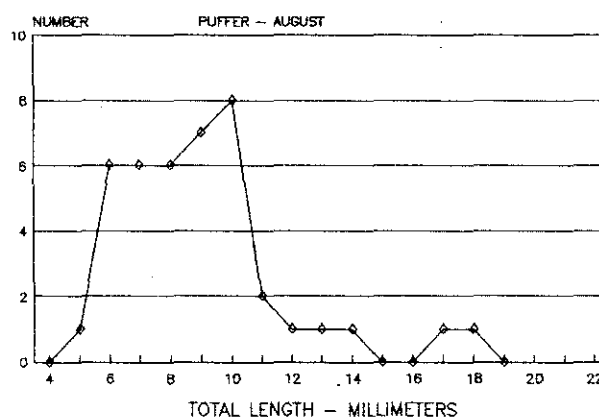
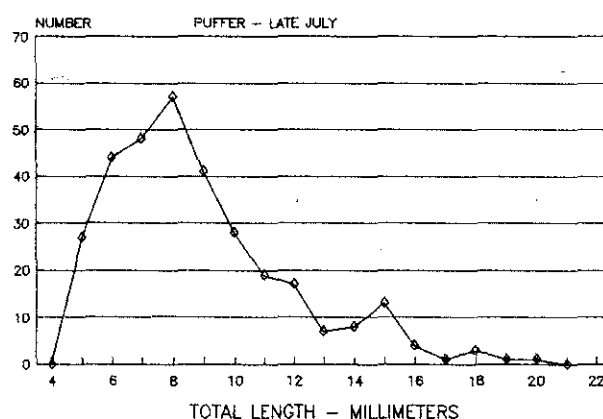
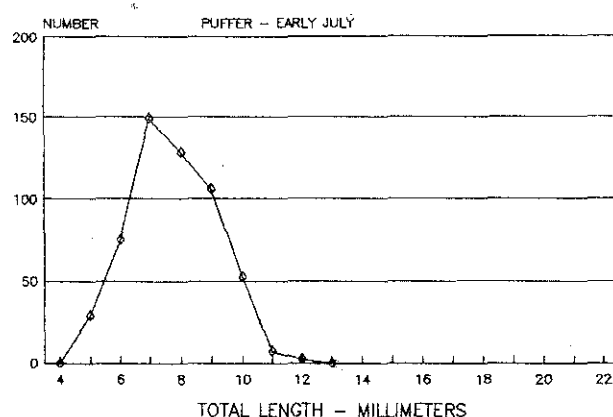


Figure 10. Length frequencies of northern puffers from Buzzards Bay neuston tows in July-August 1979.

Ostraciidae—boxfishes

Lactophrys trigonus (Linnaeus)

trunkfish

A single juvenile of this southern species, 19 mm in length, was caught September 27. This is a time of the year when southern species often are found off New England. Little is known of its breeding habits (Martin and Drewry 1978).

Tetraodontidae—puffers

Sphoeroides maculatus (Bloch and Schneider)

northern puffer

Larval and juvenile puffers occurred in tows from June 26 to October 5, with most being caught in July (Table 8, Figure 10). The catches were adjusted to reflect subsampling in July. The puffer, mainly of waters from Florida to Cape Cod, spawns from June through the summer off New England (Bigelow and Schroeder 1953). A few juvenile puffers were caught in otter trawl tows at Woods Hole (Lux and Nichy 1971).

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